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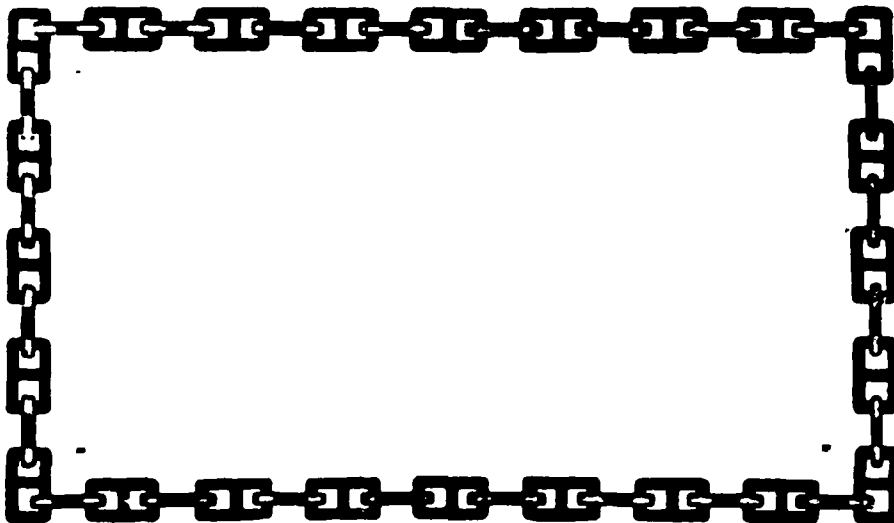
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NAVY EXPERIMENTAL DIVING UNIT
PANAMA CITY, FL 32407

NAVY EXPERIMENTAL DIVING UNIT

REPORT NO. 7-81

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6 EVALUATION OF

MK-12 SURFACE-SUPPORTED DIVING SYSTEM (SSDS) MODIFIED HELMET LOCKING DEVICES.

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the present MK-12 helmet locking device be replaced as an interim measure, with the modified configuration. For a permanent solution to the problem, a helmet locking device similar to that used on the MK-11 Dry Hat should be investigated.

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ABSTRACT

Modified helmet locking devices to secure the MK12 SSDS Helmet to the Neck Breech Ring were tested by the Navy Experimental Diving Unit (NEDU) to determine whether a new method could be incorporated into the equipment to prevent the helmet from accidentally separating from the breech ring. Test results demonstrated that a modified arrangement consisting of a new helmet locking device and safety pin will greatly reduce the possibility of the helmet and neck ring accidentally separating. It is recommended that the present MK-12 helmet locking device be replaced, as an interim measure, with the modified configuration. For a permanent solution to the problem a helmet locking device similiar to that used on the MK-11 Dry Hat should be investigated.

1. INTRODUCTION

a. Objectives

As requested by the Commander, Naval Sea Systems Command (SEA OOC) (reference paragraph V.a.) the Navy Experimental Diving Unit (NEDU) tested and evaluated modified helmet locking devices for the MK-12 Surface-Supported Diving System (SSDS).

b. Background

The devices used to secure the MK-12 SSDS Helmet to the Neck Breech Ring have been a source for concern since the conceptual phase of the MK-12, during TECHEVAL and OPEVAL and subsequent use at U. S. Navy diving schools and diving units. The equipment area causing the most obvious concern was the ball-lock pin, which occasionally failed in the open position and allowed the locking pin to slide out from the neck breech ring. Several modifications had been previously tried to eliminate this problem without success. Therefore, three new helmet locking devices were designed, fabricated and tested to ensure the helmet will not separate from the breech ring. These three candidate devices were developed by the Naval Coastal Systems Center, Panama City, FL, and the Naval Surface Weapons Center, Dahlgren, Va. Testing of the candidate devices was conducted at NEDU, two of which were similar in configuration, consisted of spring-loaded quarter-twist detent locks. The third candidate was a solid pin restrained by a detent spring.

II. TEST PROCEDURES

NOTE: Two test programs (references to paragraph V.b. and V.c.) were conducted on the candidate devices. The first test program (NEDU Test Plan 80-52) required dry ambient testing. The second test program (NEDU Test Plan 80-70) involved only wet testing.

a. Test Plan 80-52

The equipment used during this series of tests is the same as that used later for Test Plan 80-70; therefore, the list of test equipment required for both test programs will only be specified once. In addition, both test programs were conducted by NEDU at the Naval Diving and Salvage Training Center (NDSTC) pier from the YSD 39 Barge with divers from NDSTC and NEDU participating in the tests.

(1) Test Equipment. The following test equipment was required to conduct the two test programs:

- (a) Three candidate helmet locking devices.
- (b) Two MK-12 SSDS's
- (c) YSD 39 Barge
- (d) Breathing Gas (air)
- (e) NEDU FADS Compressor (backup air supply)

(2) Dry Testing. Dry testing during the first test program consisted of performing "accidental" impact tests on the candidate devices after they were installed on the MK-12 Helmet and Neck Breech Ring. Each device was tested by using the palm of the hand or a soft rubber mallet to strike the helmet locking device in an attempt to open or dislodge the locking pin. These accidental impact tests consisted of striking the locking pin from all directions (front, rear, above and below) as well as striking the pin with random direct hits. In addition, a snag test was performed by dragging a line across the helmet locking device in forward and aft and up and down directions in an attempt to dislodge the locking pin.

(3) Wet Testing. Wet testing consisted of divers donning the MK-12 and simulating diving activities that may occur during salvage, search, rescue and repair operations. These diving activities included tunneling, entry and exit from a ship's hull and ship repair and husbandry operations. Each dive was performed for approximately 45 minutes with the diver performing underwater operations that simulated the worst conditions the MK-12 helmet is expected to experience in the field. 15 dives were made during this test program.

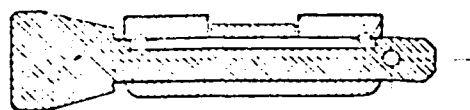
b. Test Plan 80-70

This test program was performed in the same way as that specified for Test Plan 80-52 with the exception that no dry testing was conducted. Wet testing consisted of 12 dives with the same test conditions as those specified for Test Plan 80-52.

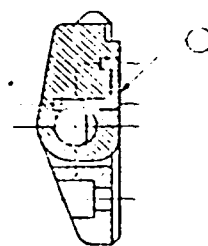
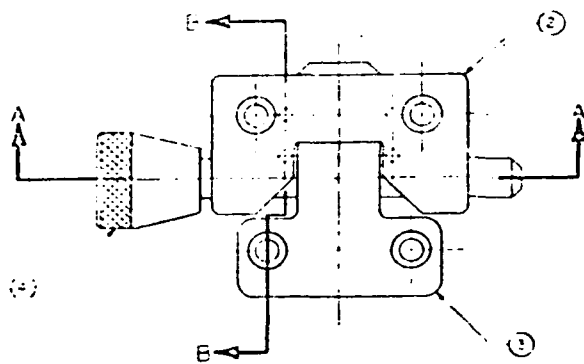
III. RESULTS AND DISCUSSION

a. Figure 1 depicts the Helmet Locking Device that was selected to eliminate the possibility of the MK-12 Helmet separating from the Neck Breech Ring. The configuration of this device presents the helmet from lifting off the breech ring even if one of the locking pins is dislodged or slips out of position. As shown in Figure 2, the lower locking device lug on the breech ring has a protruding guide that slips into the upper helmet locking lug and prevents the helmet from lifting off on one side when the opposite helmet pin is inserted in its proper position. In addition the two screws securing the lower locking lug to the lower breech ring have been increased in size from a 6-32 threads per inch (TPI) to an 8-32 TPI screw. This change was incorporated for two reasons; the first for standardization of screw size in the MK-12 SSDS Helmet Locking Devices and the second for increased strength in securing the lower locking lug to the lower breech ring assembly.

b. The ball-lock helmet locking pins have been replaced by a similar, modified pin that has a 0.125-inch drilled hole in the end (Figure 3 refers) to allow the placement of a safety pin to ensure more positive locking. 4



SECTION A-A



SECTION B-B

FIGURE 1. NEW HELMET LOCKING DEVICE

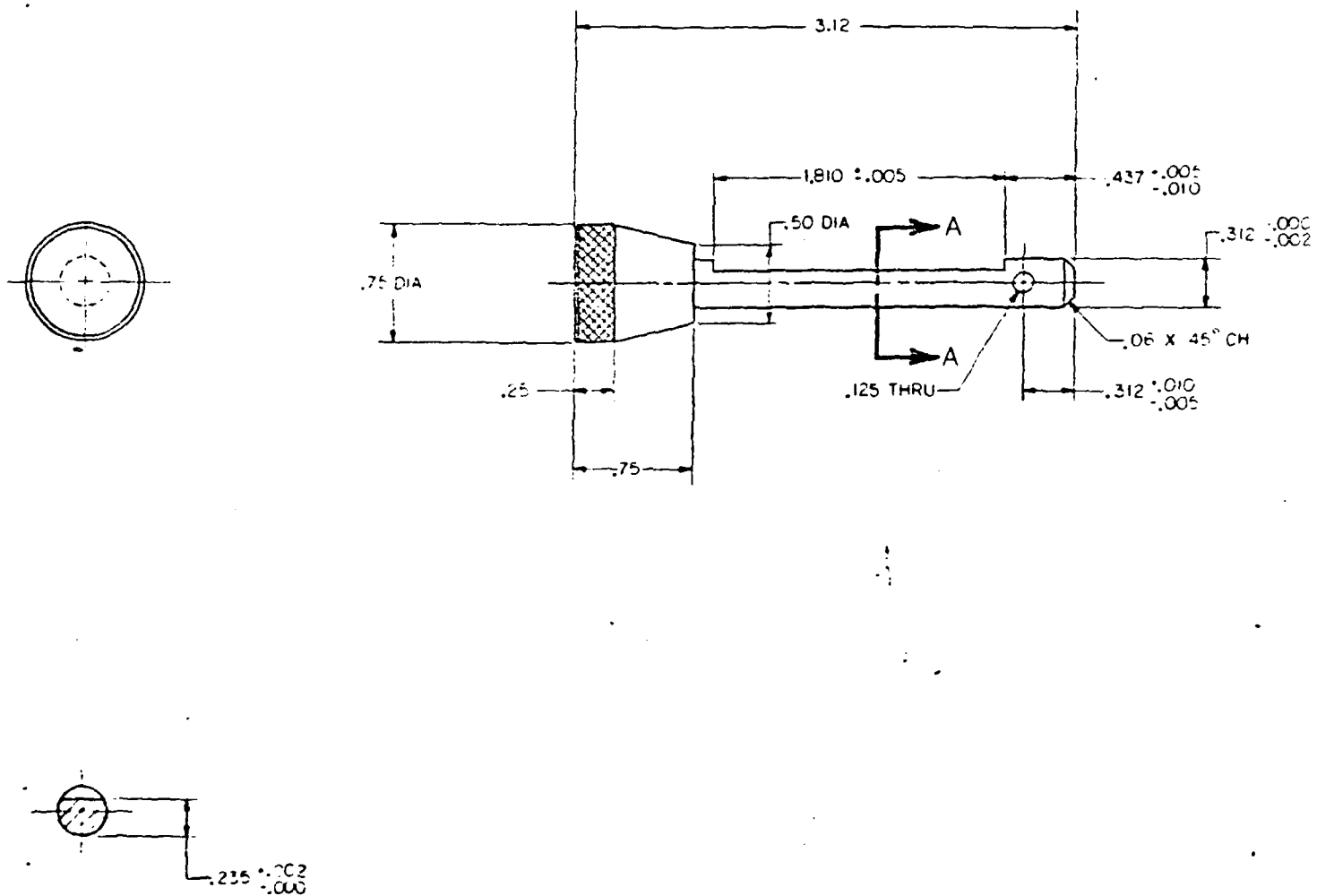


FIGURE 3. MODIFIED LOCKING PIN

The locking pin is installed on the helmet locking device with a drag pin (see Figure 4) incorporated into the upper helmet locking lug assembly. This drag pin applies friction on the locking pin and prevents it from sliding in or out when the helmet is tilted in any direction even without the safety pin in place. The locking pin is a slotted machined pin, which enables the drag pin to operate properly. This configuration limits the amount of in and out movement of the locking pin. Also, a drag spring is incorporated to help prevent loss of the locking pin if it is in the open or unlocked position.

The new safety pin incorporated into the redesigned MK-12 Helmet Locking Device provides a positive-locked condition (see Figure 5). This makes it almost impossible for the pin to open if a diver should snag it on some obstacle.

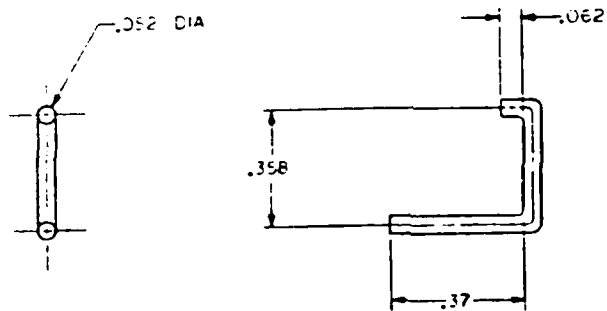


FIGURE 4. DRAG PIN

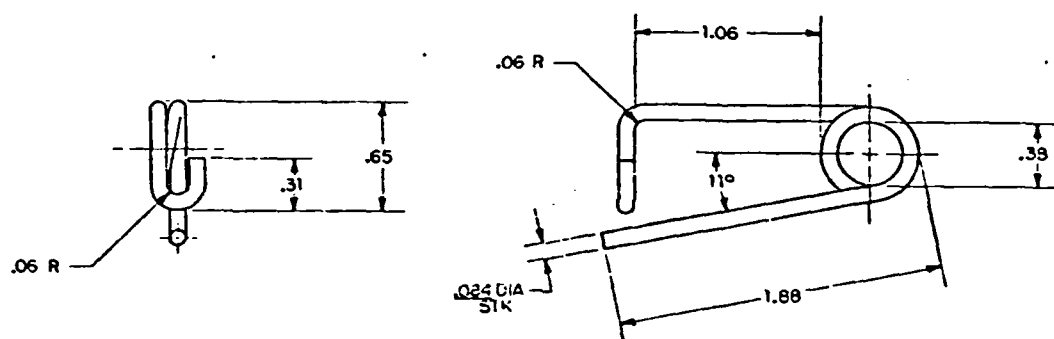


FIGURE 5. SAFETY PIN

IV. CONCLUSIONS AND RECOMMENDATIONS

a. Conclusions

The modified MK-12 Helmet Locking Device and Safety Pin addition were tested successfully. The two test programs (Test Plan 80-52, conducted 12 and 13 November 1980 and Test Plan 80-70, conducted 16 December 1980) confirmed that the modifications should eliminate the possibility of the helmet separating from the Neck Breech Ring.

b. Recommendations

(1) It is recommended that NAVSEA (SEA-00C) authorize incorporating the new Helmet Locking Device and Safety Pin into the MK-12 SSDS.

(2) As a result of additional experience gained with the MK-11 Dry Hat, it is recommended a similar type of Helmet Locking Device currently in use with this Dry Hat be incorporated for use with the MK-12 SSDS. This type of configuration would therefore create uniformity between the MK-11 Dry Hat, the MK-12 SSDS and the MK-14 Deep Dive System.

V. REFERENCES

- a. NAVSEA (SEA 00C) Task 80-18 dtd 23 September 1980
- b. NEDU Test Plan 80-52 dtd October 1980
- c. NEDU Test Plan 80-70 dtd December 1980

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